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| RAO, SHRINIVAS H | | | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/752,993

Applicant(s)

NAKAJIMA, SETSUO

Examiner

STEVEN H. RAO

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2008.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-10, 12-16, 18-22, 24-28, 30-34 and 36-100 is/are pending in the application.
4a) Of the above claim(s) 92-98 is/are withdrawn from consideration.
5) ☐ Claim(s) 1-4, 6-10, 12-16, 18-22, 24-28, 30-34, 36 and 37-54 is/are allowed.
6) ☐ Claim(s) 55-91 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) 92-98 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 18 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 10/131503.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 02/29/08
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Priority

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114.

Applicant's submission filed on 03/08/2008 has been entered.

Claims 1-4, 6-10, 12-16, 18-22, 24-28, 30-34 and 36-100 are currently pending.

Claims 5,11,17,23,29 and 35 have been cancelled.

Claims 92 to 98 are withdrawn from consideration as per the following Election/Restriction requirement.

Election/Restrictions

Newly submitted claims 92 to 98 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Previously submitted claims are method claims directed to a method of manufacturing a semiconductor device comprising several steps.

Newly submitted claims 92 to 98 are directed to a semiconductor device having a glass substrate, whereas the method claims do not require semiconductor device to be formed on a glass substrate. Further the device claims do not require the crystalline semiconductor film of the semiconductor device to be crystallized by radiating with laser beam using a lens.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 92-98 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Allowable Subject Matter

Claims 1-4,6-10,12-16,18-22,24-28,30-34,36 -54 and 99-100 are allowed. The applied prior art of record taken either singularly or in combination fails to anticipate or fairly suggest the limitation of the dependent claims, in such manner that a rejection under 35 U.S.C. 102 or 103 would be proper. The prior art fails to teach a combination of all the claimed features as presented in independent claim/s (1, 7,13,19, 25 and 31)including the steps of, "forming a semiconductor film over an insulating surface..., forming an oxide film on the semiconductor film..., radiating the semiconductor film with a first laser beam using a lens..., radiating the semiconductor film with a second laser beam after radiating with the first laser beam..., radiating the semiconductor film with a third laser beam after radiating with the second laser beam..., wherein a wavelength of the second laser beam and a wavelength of the third laser beam are different from a wavelength of the first laser beam". (as stated in Applicants' remarks [amdt.6/28/2007] pages 1, 17-18 and page 15). See also Terminal Disclaimer over 6,706,568.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 55 to 91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nitta et al. (U.S. Patent No. 6,304,329 herein after Nitta) and in view of Sasaki et al. (U.S. Patent No. 5,213,654 herein after Sasaki) and Mitnaga et al. (U.S. Patent No. 5,808,321, herein after Mitnaga).

With respect to claims 55 Nitta describes a method for manufacturing a semiconductor device comprising: forming a crystalline semiconductor film over an insulating surface (Nitta col. 9 lines 2-3, SOI) ; irradiating the crystalline semiconductor film with a laser beam (Nitta col. 12 line 63).

Nitta does not specifically mention laser irradiation in a gas selected from at least one of a hydrogen and an inert gas .

Sasaki, a patent from the same field of endeavor describes in col. 3 lines 35-37 describes laser irradiation in a gas selected from at least one of a hydrogen and an inert gas to control growth temperature and thus control thickness of the film grown to a monatomic scale.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to Include Sasaki's gas selected from at least one of a hydrogen and an inert gas in Nitta's method of unspecified irradiating the crystalline semiconductor film with a laser beam. The motivation for the above combination is to control growth temperature and thus control thickness of the film grown to a monatomic scale. (Sasaki col. 2 lines 60-65).

The remaining limitation of claim 55 :

to level a surface of the crystalline semiconductor film.

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Nitta and Sasaki describe the semiconductor device of claim 1, but does not specifically mention its laser treatment is for the purpose of forming a crystallized semiconductor film.

Mitanaga a patent from the same filed of endeavor, describes in col. 1 lines 20-25, 45-47 etc. describe wherein the radiating the semiconductor film with the first laser beam is held in order to form a crystallized semiconductor film, to crystallize the film at low temperature so as to avoid substrate deformation and reduce the heating time from several ten hours or more necessary for crystallization to about an hour and produce a product having the desired properties.

Therefore it would have obvious to one of ordinary skill in the art at the time of the invention to use Mitnaga's laser annealing in Nitta's method. The motivation for which is to crystallize the film at low temperature so as to avoid substrate deformation and reduce the heating time from several ten hours or more necessary for crystallization to about an hour and produce a product having the desired properties. (Mitnaga col. 2 lines 10-18 ,etc.).

With respect to claims Nitta 56,77 and 83, describes the method for manufacturing the semiconductor device according to claim 55, wherein the inert gas is selected from the group consisting of nitrogen, argon, helium, neon, krypton and xenon. (Sasaki col. 2 lines 60-65).

With respect to claim 57 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the crystalline semiconductor film is a silicon film or a SiGe ($0 < x < 1$) film. (Mitnaga –summary of the invention section).

With respect to claim 58,78 and 84 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the insulating layer is a single layer film structure or a stacked structure of two insulating films formed on a glass substrate. (Mitnaga 106)

With respect to claim 59 Nitta describes the method for manufacturing the semiconductor device according to claim 58, wherein a thickness of the glass substrate is 0.4 to 0.7 m.m. (Mitnaga col. 13 line 40)

With respect to claims 60 Nitta describes the method for manufacturing the semiconductor device according to claim 58, wherein the glass substrate is 1200 x 1600 mm or 2000 x 2500 mm in length. (Mitnaga col. 13 line 41).

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With respect to claims 61, 79 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the laser beam is a linear laser beam. (Mittinaga col. 11)

With respect to claims 62 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the crystalline semiconductor film is scanned by the laser beam plural times. (Mittinaga col. 12 lines 10-15, 2-10 times)

With respect to claim 63 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the energy density of the laser beam is larger than 300 to 500 mJ/cm². (Mitanaga col. 12 lines 13-15,)

With respect to claim 64 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the laser beam is one of an excimer laser beam and a YAG laser beam. (Mitanaga col. 10 line 66-excimer)

With respect to claim 65 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the laser beam is a XeCl laser beam. (Mitanaga col. 10 line 66-XeCL).

With respect to claims 66, 80, 85 and 90 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the crystalline semiconductor is heated at 450° to 600° after leveling the surface of the crystalline semiconductor. (Mitanaga col. 12 line 17).

With respect to claim 67 Nitta describe the method for manufacturing the semiconductor device according to claim 55, wherein the crystalline semiconductor is heated by a RTA method after leveling the surface of the crystalline semiconductor. (well known in the art to use RTA method to heat).

With respect to claim 68 Nitta describe the method for manufacturing the semiconductor device according to claim 55, after irradiating the crystalline semiconductor film, a difference between top and bottom points of the surface of the crystalline semiconductor film is 6 nm or less. (Makita col. 20 lines 20-25).

With respect to claim 69 Nita describes the method for manufacturing the semiconductor device according to claim 55, wherein an energy density of the laser beam is 430 mJ/cm^2 and a pulse width of the laser beam is 30 ns. (Mitinaga col. 5 col. 12 lines 10-15, Sasaki figs. 2,3, col. 4 lines 15-20).

With respect to claims 70 and 81 Nitta describes the method for manufacturing the semiconductor device according to claim 55, further comprising a step of hydrogenating the crystalline semiconductor film. (Sasaki col. 4 lines 20-25).

With respect to claim 71 ,87 & 88 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the gas is jetted to the crystalline semiconductor film from a nozzle. (Sasaki fig. 1)

With respect to claim 72 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein a gas is jetted to the crystalline

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semiconductor film from below the crystalline semiconductor film.(well known in the art to jet gas from below instead of jetting from sides).

With respect to claim 73 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the semiconductor device is a display device. (Mitanaga col. 15 lines 39-40).

With respect to claims 74 Nitta describes the method for manufacturing the semiconductor device according to claim 55, wherein the semiconductor device is an active matrix type liquid crystal display device. (Mitanaga col. 15 lines 39-40).

With respect to claim 75 Mita describes the method for manufacturing the semiconductor device according to claim 55, wherein the semiconductor device is an electronic apparatus selected from the group of a video camera, a digital camera, a rear type or front type projector, a head mount display, a personal computer, a portable information terminal, a mobile computer, a mobile telephone and an electronic book. (Mitanaga col. 15 lines 39-40 LCDs commonly used in digital cameras , video cameras, etc.).

With respect to claim 76 Mita describes a method for manufacturing a semiconductor device comprising: forming a crystalline semiconductor film over an insulating surface, (Nitta col. 9 lines 2-3, SOI) wherein a surface of the crystalline semiconductor film has a roughness (Makita fig. 15) ; irradiating the crystalline semiconductor film with a laser beam in a gas selected from at least one of a hydrogen and an inert gas (Sasaki col. 2

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lines 60-65) so that a difference between top and bottom points of the roughness of the surface of the crystalline semiconductor film is 6 nm or less. (Makita col. 20 lines 20-25).

With respect to claim 82 Mitta describes a method for manufacturing a semiconductor device comprising: forming a crystalline semiconductor film over an insulating surface; (Nitta col. 9 lines 2-3, SOI) irradiating the crystalline semiconductor film with a linear laser beam in a gas selected from at least one era hydrogen and an inert gas to level a surface of the crystalline semiconductor film, (Sasaki col. 2 lines 60-65) wherein the crystalline semiconductor film is hydrogenated by a heating process. (Sasaki col. 3 lines 35-37).

With respect to claim 86 Mitta describes a method for manufacturing the semiconductor device comprising: disposing a substrate on a stage where a semiconductor film is formed over the substrate; (Sasaki fig.1 #13) floating the substrate over the Stage by supplying a gas to a side of the substrate which faces toward the stage; (Sasaki fig. 1) irradiating the semiconductor film with a linear laser beam while the substrate is floated; (Sasakai fig. 1) and moving the substrate while irradiating the semiconductor film with the linear laser beam. (Sasaki fig.1 #13 moved (rotated by 3)

With respect to claim 89 Mitta describes a method for manufacturing a semiconductor device according to claims 86, wherein the semiconductor film is crystallized by the laser beam. (Mitta col. 9 lines 2-3, SOI)

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With respect to claim 90, Mitta describes a method for manufacturing a semiconductor device according to claims 86, wherein a surface of the semiconductor film is leveled by the laser beam. (Makita col. 20 lines 20-25).

With respect to claim 91Mitta describes a method for manufacturing a semiconductor device according to claims 86, wherein an oxidized film formed on the semiconductor film is abraded by the laser beam. (Sasaki col. 4 lines 1-20).

Response to Arguments

Applicant's arguments with respect to claims 55-100 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEVEN H. RAO whose telephone number is (571)272-1718. The examiner can normally be reached on 8.30-5.30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1714. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Steven H Rao/

Examiner, Art Unit 2814